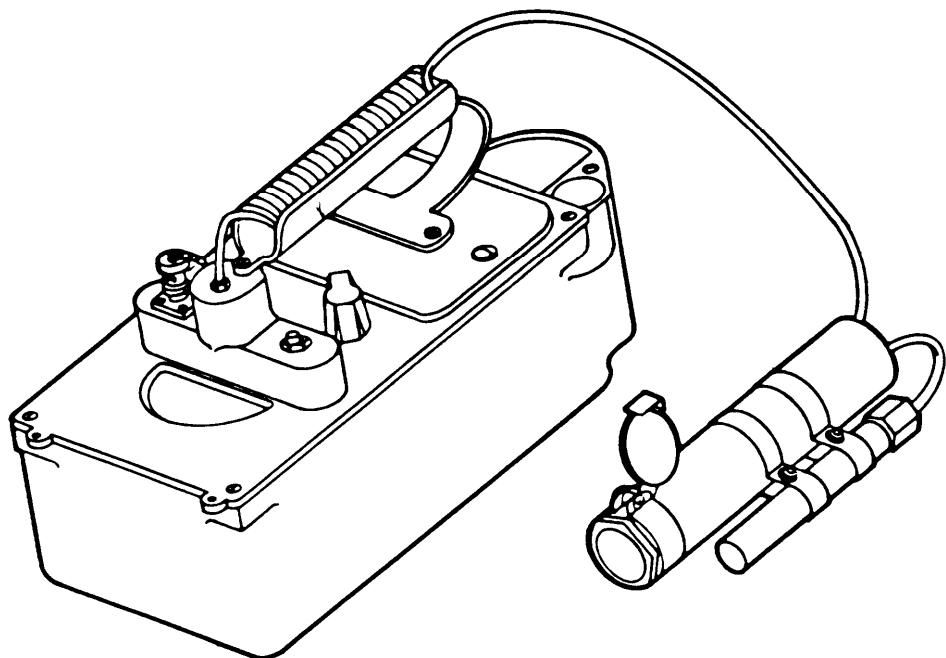


TM 11-6665-230-34

**TECHNICAL MANUAL
DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE MANUAL**



**RADIAC SET AN/PDR-27R
(NSN 6665-00-961-0846)**

**HEADQUARTERS, DEPARTMENT OF THE ARMY
3 SEPTEMBER 1984**

WARNING

HIGH VOLTAGE

DEATH ON CONTACT

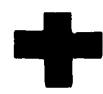
Be careful when working on this equipment.
The high voltage power supply produces 680 volts dc.



KRYPTON 85

The Radioactive Test Sample MX-7338/PDR-27 contains 5 millicuries of KRYPTON 85. Damage to body tissue can result from mishandling.

Refer to TM 3-6665-264-10 for specific instructions on control, safe handling, inspection, storage and disposition of the test sample.



5

SAFETY STEPS TO FOLLOW IF SOMEONE
IS THE VICTIM OF ELECTRICAL SHOCK

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3 IF YOU CANNOT TURN OFF THE ELECTRICAL
POWER, PULL, PUSH, OR LIFT THE PERSON TO
SAFETY USING A WOODEN POLE OR A ROPE OR
SOME OTHER INSULATING MATERIAL

4 SEND FOR HELP AS SOON AS POSSIBLE

5 AFTER THE INJURED PERSON IS FREE OF
CONTACT WITH THE SOURCE OF ELECTRICAL
SHOCK, MOVE THE PERSON A SHORT DISTANCE
AWAY AND IMMEDIATELY START ARTIFICIAL
RESUSCI TATION

Technical Manual

No. 11-6665-230-34

**HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 3 September 1984**

**DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE MANUAL**

**RADIAC SET AN/PDR-27R
(NSN 6665-00-961-0846)**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007. In either case, a reply will be furnished direct to you.

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*This manual, together with, TM 11-6665-230-12, 3 September 1984, supersedes TM 11-6665-230-15, 20 June 1967, including all changes.

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HOW TO USE THIS MANUAL

- This manual describes the General Support maintenance function only.
- Direct Support maintenance is not applicable.
- Chapters, sections, paragraphs and tables are listed in numeric sequence.
- Pay particular attention to all **WARNINGS** and **CAUTIONS** appearing in this manual.

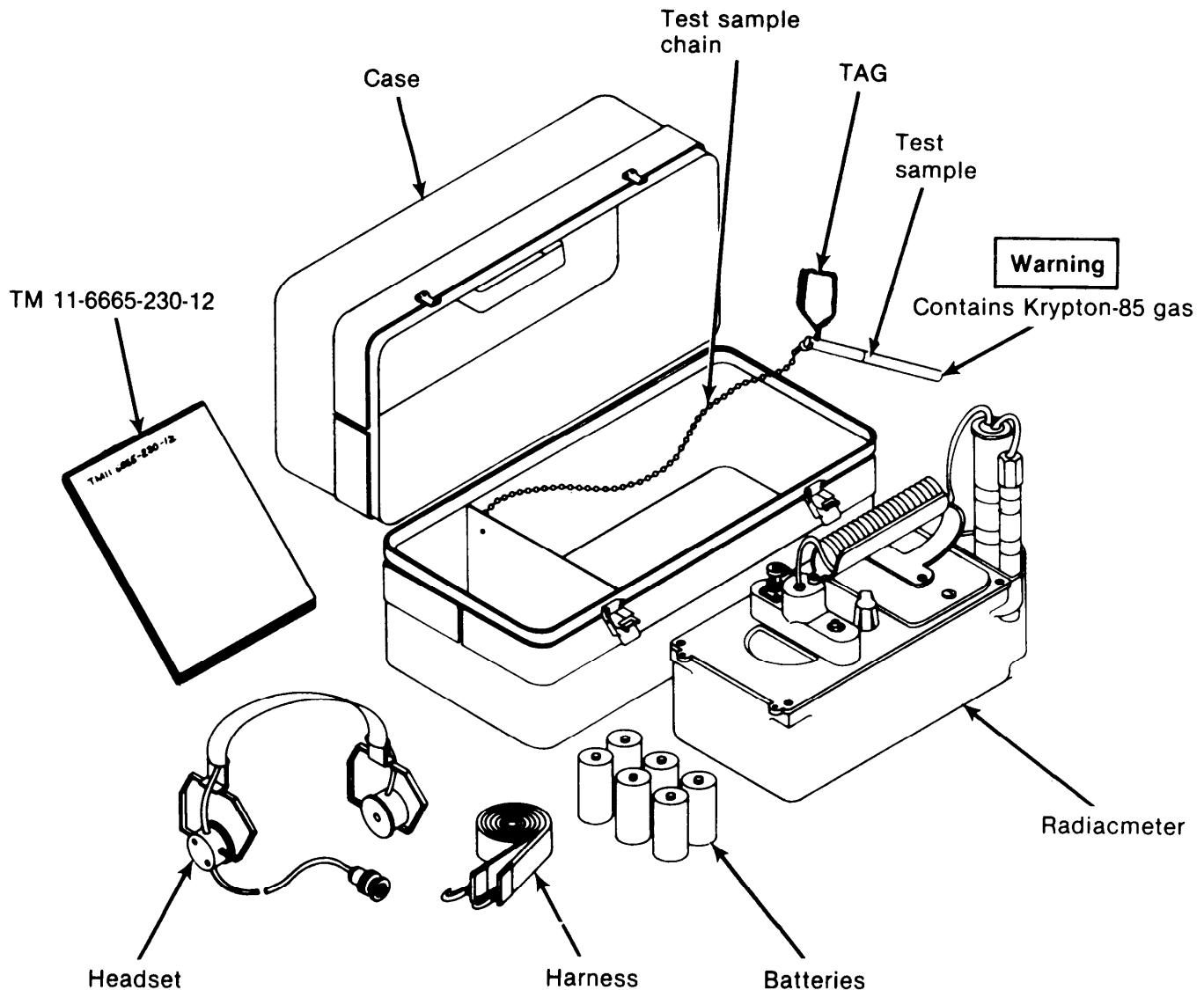


Figure 1-1. Radiac Set AN/PDR-27R.

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. Scope

- a. This manual describes general support maintenance for Radiac Set, AN/PDR-27R. It includes instructions for troubleshooting, repairing and testing the equipment. It also lists all the tools, test equipment, and materials required for maintenance and calibration.
- b. Radiac Set AN/PDR-27R detects beta radiation and measures and detects gamma nuclear radiation. Operating instructions and organizational maintenance is covered in TM 11-6665-230-12.

1-2. Consolidated Index of Publications and Blank Forms

Refer to the latest issue of DA PAM 310-1 to determine whether there are new editions, changes or additional publications pertaining to this equipment.

1-3. Maintenance Forms, Records, and Reports

- a. *Reports of Maintenance and Unsatisfactory Equipment.* Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAM MS) as contained in Maintenance Management Update.
- b. *Report of Packaging and Handling Deficiencies.* Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4240.55/NAVMATINST 4355.73A/AFR 400-54/MCO 4430.3F.
- c. *Discrepancy in Shipment Report (DISREP)* (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-4. Calibration

Radiac Set AN/PDR-27R will require calibration using Calibrator Set, Radiac AN/UDM-2. The applicable calibration procedure is located in TM 11-6665-227-12 (Strontium-90).

1-5. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-6. Administrative Storage

Administrative Storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing (TM 11-6665-230-12). When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in TM 11-6665-230-12.

1-7. Reporting Equipment Improvement Recommendations (EIR)

If your Radiac Set AN/PDR-27R needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007. We'll send you a reply.

1-8. Nomenclature Cross Reference List

See TM 11-6665-230-12.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-9. Equipment Purpose, Capabilities, and Features

See TM 11-6665-230-12.

1-10. Location and Description of Major Components

See TM 11-6665-230-12.

1-11. Differences in Models

Radiac Set AN/PDR-27R is similar in appearances to Radiac Sets AN/PDR-27J, AN/PDR-27L, AN/PDR-27P and AN/PDR-27Q, and performs the same functions. It differs from these models only in its internal circuitry.

1-12. Equipment Data

See TM 11-6665-230-12.

1-13. Safety Care and Handling

WARNING



The test sample used in this equipment is radioactive. Damage to body tissue can result from mishandling.

- Do not remove the test sample from the chain attaching it to the carrying case.
- Do not handle the test sample by the radioactive end (purple end).
- Do not prolong exposure to the radiation and handle the test sample unprotected.

1-14. Reference Designations and Abbreviations

- Unit and assembly numbers represent the radiac set's assemblies.

Unit 1 - Radiacmeter Panel

Unit 2 - Radiac Detector, DT-196/PDR

Assembly 1A1 - Low Voltage PC Board

Assembly 1A2 - High Voltage PC Board

Example: Capacitor C1 of Assembly 1A1 is designated 1A1C1.

- Abbreviations of component parts complete the full reference designations.

Example: Meter M1, on Unit 1 is designated 1M1.

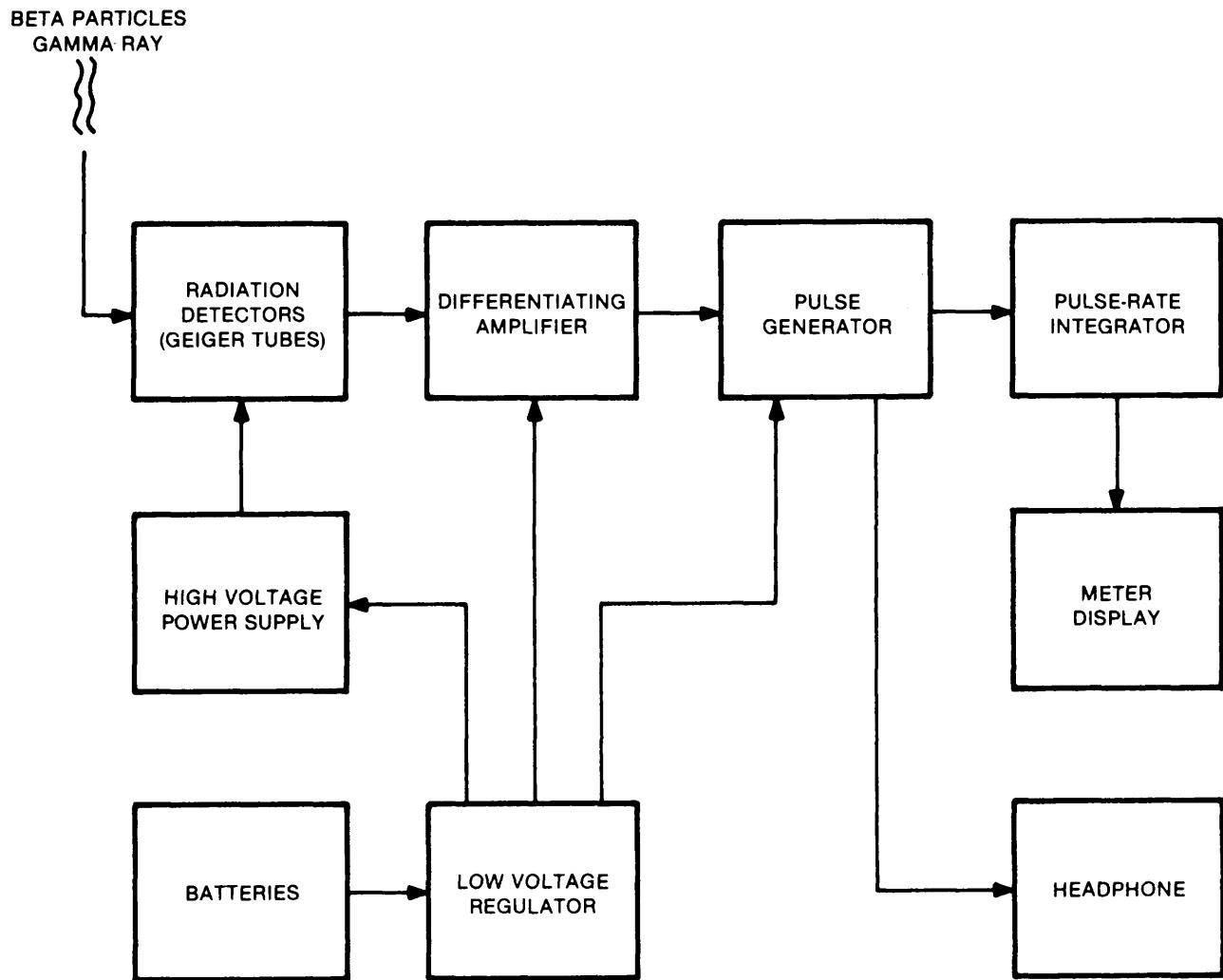


Figure 1-2. Radiac Set, AN/PDR-27R, Functional Block Diagram.

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-15. Functional Block Diagram

(fig. 1-2)

The functional block diagram for Radiac Set, AN/PDR-27R is illustrated in figure 1-2. The high voltage power supply furnishes a dc voltage to energize the Geiger-Mueller tubes. Beta particles (on the 0.5 and the 5.0 mR/hr. ranges) and gamma rays cause the Geiger Mueller tubes to produce voltage pulses which are then fed through a differentiating amplifier to a pulse generator followed by an integrator circuit. The pulse generator provides pulses to the headphone for aural monitoring and supplies a direct current, proportional to the average pulse repetition frequency, to the indicating meter.

NOTE

Power for all functional blocks is obtained from dry cells through the voltage regulator. The regulator circuit assures that all operating voltages are maintained constant throughout the useful life of the batteries (battery life is in excess of 100 hours).

1-16. Functional Section Description

(fig. FO-2)

a. *Voltage Regulator*. The battery voltage, which may vary from 9.3 to 6.6 volts dc during the useful life of the batteries, is fed to transistor 1A1Q1. The regulated voltage for the other circuitry in the equipment is taken from the collector of 1A1Q1. This voltage is sampled by a differential amplifier composed of transistors 1A1Q2 and 1A1Q3. The difference between the sample voltage and the fixed reference voltage is then amplified and fed as negative feedback to the base of 1A1Q1. The output voltage of the regulator circuit is then held constant over a wide range of input voltage variations. The value of the sample voltage is determined by the setting of potentiometer 1R3. The high voltage power supply develops a voltage proportional to the regulated low voltage, and 1R3 is used to adjust the high voltage to a precise value. The regulated low voltage (about 5 volts dc) is adequate for operating the other circuitry.

b. *High Voltage Power Supply*.

(1) The high voltage is developed by generating a square wave in an astable multivibrator, composed of transistors 1A1Q5 and 1A1Q6 and feeding this square wave into a linear step-up transformer 1A2T1. Oscillation is maintained in the astable multivibrator through a positive feedback loop from the collector of transistor 1A1Q5 through diode 1A1CR3, and capacitor 1A1C3, to the base of transistor 1A1Q6 and from the collector of 1A1Q6 through diode 1A1CR2, and through capacitor 1A1C1. Resistors 1A1R10 and 1A1R11 are the resistive collector loads for transistors 1A1Q5 and 1A1Q6. When power is first applied, resistors 1A1R9 and 1A1R12 supply forward bias current to the bases of transistors 1A1Q5 and 1A1Q6. However, due to slight unbalances in the circuitry associated with these two transistors, 1A1Q5 draws slightly more current than 1A1Q6 and its collector swings positive, thus transmitting a positive voltage step to the base of 1A1Q6, cutting 1A1Q5 off. The coupling capacitor (1A1C1 or 1A1C3, whichever the case may be) then charges toward ground potential and when it reaches a potential approximately 0.2 volts more negative than the emitters of transistors 1A1Q5 and 1A1Q6, the cut-off transistor begins to conduct thus initiating a reversal of conduction state between the two transistors which develops another such half-cycle and oscillation is sustained.

(2) The output of the multivibrator is applied through diodes 1A2CR5 and 1A2CR6 to the primary of 1A2T1. These latter diodes in conjunction with diodes 1A1CR2 and 1A1CR3 insure that no feedback path is established through the transformer back to transistors 1A1Q5 and 1A1Q6. Any such path would include two back-to-back series diodes, one which would of necessity be reverse biased, and thus effectively oppose any signal transfer along the path. Approximately 400 volts peak-to-peak, at the secondary of 1A2T1 are then available to operate the voltage quadruple consisting of 1A2CR1 through 1A2CR4 and the associated capacitors, 1A2C1 through 1A2C4. A ripple filter, consisting of resistors 1A2R1, 1A2R2, and capacitors 1A2C5, and 1A2C6, reduces the ac component to a negligible value. Resistors 1A2R3 and 1A2R4 act as a bleeder on high voltage supply to discharge the filter capacitors when power is removed.

c. *Radiation Detectors.* The 680 V dc high voltage output supplies the two Geiger-Mueller tubes, 2V1 and 2V2, through the range switch 1S1. The switching contacts of the range switch 1S1 are connected so that Geiger-Mueller tube 2V1 is energized at all times (on all four ranges). Geiger-Mueller tube 2V2 is only in the circuit on the 0.5 mR/hr. and 5.0 mR/hr. ranges.

d. *Computer-Integrator Circuitry.*

(1) When radiation causes either of the Geiger-Mueller tubes to discharge, a negative voltage pulse is applied to the input of the differentiating amplifier 1A1Q7. Diodes 1A1CR4 and 1A1CR5 prevent damage to 1A1Q7 in the event of very high voltage pulses by shunting the excess current to ac ground. The output of transistor 1A1Q7 is taken from the collector and fed through a small capacitor 1A1C5 to the monostable multivibrator composed of transistors 1A1Q8, 1A1Q9 and their associated components. The normal state of the monostable multivibrator corresponds to full conduction (saturation) of transistor 1A1Q9 since its base is returned to the 5 V dc supply through one of the following resistor networks, depending on the setting of the range switch, 1S1.

| RANGE | RESISTOR NETWORK |
|------------|---------------------|
| 0.5 mR/hr. | 1R7, 1R10 |
| 5.0 mR/hr. | 1R6, 1R9 |
| 50 mR/hr. | 1R5, 1R8 |
| 500 mR/hr. | 1R4, 1A1R30, 1A1R25 |

Transistor 1A1Q8 is normally turned off, since its base is returned to ground through resistor 1A1R20 and to the collector of transistor 1A1Q9 through resistor 1A1R21 and diode 1A1CR7. Since 1A1Q9 is saturated, as described above, the entire 5 V dc supply is dropped across its collector load resistor 1A1R26. The collector sits at 0.2 volts above ground. The base of transistor 1A1Q8 is returned to potentials less than the 0.6 volt barrier potential necessary to initiate conduction keeping 1A1Q8 at cut off. The meter 1M1 is in series with resistors 1A1R24 and 1A1R22, and form the collector load impedance of 1A1Q8. The absence of current in the 1A1Q8 causes the meter 1M1 to indicate zero in the normal state of the monostable multivibrator.

(2) When a positive going pulse arrives at the base of transistor 1A1Q8 from the collector of transistor 1A1Q7, transistor 1A1Q8 begins to conduct. Therefore, a negative going step appears at the collector of 1A1Q8, and this step is transferred through one of the coupling-timing capacitors, 1A1C8 through 1A1C11, to the base of transistor 1A1Q9. This causes 1A1Q9 to come out of saturation, and a positive going step thus appears at the collector of 1A1Q9. This latter positive going step is fed back to the base of 1A1Q8 through diode 1A1CR7 and resistor 1A1R21. This positive going step reinforces the original positive pulse which initiated the process. This regenerative action continues until 1A1Q8 is completely saturated and 1A1Q9 is completely cut off. At this point, since 1A1Q8 has gone from cutoff to full conduction, it is evident that a negative going step equal in magnitude to the 5 volt supply voltage is generated. The base of 1A1Q9 sits at a potential approximately 4.4 volts negative with respect to ground. However, the base of 1A1Q9 is always returned to the positive 5 volt supply through a resistor network. This enables the coupling capacitors in the circuit (1A1C8 through 1A1C11) to begin to charge toward the 5 V dc supply. After a time, determined by the value of the capacitor, by the total series resistance, and by the voltage towards which the capacitor is changing, the base of 1A1Q9 reaches a potential about 0.6 volts above ground and 1A1Q9 begins to conduct. Now, the feedback causes a rapid return of the circuit to its normal state. The result of this action causes each received pulse from the Geiger-Mueller tubes 2V1 and 2V2 to develop a fixed current to flowing into 1A1Q8's collector load (including the meter 1M1) for a fixed period of time. This time is determined by the electrical characteristics of the components in the base circuit of 1A1Q9. As long as the fixed conduction time interval is small compared to the average interval between received pulses, the average current through 1M1 will be directly proportional to the average repetition rate of the received pulses. Capacitor 1A1C7 smooths out the current pulses to the meter 1M1 so that rapid fluctuations are suppressed.

(3) On the 500 mR/hr range, it should be noted that the monostable multivibrators coupling capacitor 1A1C8 is returned to the positive supply voltage through resistors 1R4, 1A1R30, and 1A1R25. If the multivibrator has remained in its normal or stable state for several seconds, it can be seen that capacitor 1A1C12 will be charged to a positive voltage a few tenths of a volt below the supply voltage. If a

single pulse should now arrive from the Geiger-Mueller tube 2V1 the total charge which would pass through meter 1M1 would be determined by the time that 1A1Q8 remained in the conducting state.

(4) At high pulse repetition rates, there is a greater probability of losing pulses because of the dead time of the system, so that we would like each pulse to have a somewhat greater effect in order to maintain the system's linearity. Therefore, the average voltage across 1A1C12 is reduced more and more as the pulse repetition rate increases because of the connection through 1A1CR8 and 1A1R23 to the collector of 1A1Q8, which drains charge from 1A1C12 during and only during the quasi-stable period of operation. This comprises the so-called Disc circuit to compensate for dead time.

(5) In order to prevent the circuit from locking up in the quasi-stable state, a clamp circuit composed of 1A1Q10, 1A1R27, and 1A1R28 is connected across 1A1C12. Thus, if the voltage across 1A1C12 attempts to drop below approximately 2.4 V dc, 1A1Q10 begins to conduct strongly and maintains 1A1C12 at that potential, providing forward bias for 1A1Q9 under any conditions.

(6) In addition, the pulse occurring at the collector of 1A1Q9 is fed to the BNC headphone connector 1J3 for aural monitoring of the detected pulses.

CHAPTER 2

GENERAL SUPPORT MAINTENANCE

Section 1. GENERAL INFORMATION

WARNING

Death on contact may result from contact with high voltage in this equipment. The high voltage power supply produces 680 volts dc.

2-1. General

This chapter covers general support troubleshooting, maintenance, and test procedures for the radiacmeter.

WARNING

The test sample used in this equipment is radioactive. Damage to body tissue can result from mishandling.

- Do not remove the test sample from the chain attaching it to the carrying case.
- Do not handle the test sample by the radioactive end (purple end).
- Do not prolong exposure to the radiation and handle the test sample unprotected.

2-2. Maintenance Data

- a. Normal waveform characteristics are shown in figure FO-1.
- b. Transistor voltages obtained with equipment in normal operating condition are shown in table 2-2.
- c. Use Radiac Calibrator Set AN/UDM-2 to calibrate the equipment.
- d. Replacement of parts on printed circuit boards (fig. 2-1 and fig. 2-2) will be performed only at an authorized radiac repair facility.
- e. Parts location index and schematic diagram for this equipment are shown in figure FO-2.

NOTE

Replacement of any major component will require recalibration of this equipment.

2-3. Repair Parts, Tools, Test Equipment and Materials

- a. Repair parts applicable to this equipment are listed in TM 11-6665-230-40P.
- b. Disassembly instructions and maintenance repair parts for Headset, Electrical H-43 B/U are shown in TM 11-5965-247-35P.
- c. Tools and test equipment required in the maintenance and troubleshooting of this equipment are listed as follows:

TOOLS

Nomenclature

National Stock Number

Tool Kit, Electronic Equipment TK-105/G

5180-00-610-8177

TEST EQUIPMENT

| | |
|--------------------------------|------------------|
| Radiac Calibrator Set AN/UDM-2 | 6665-00-179-9037 |
| Multimeter AN/PSM-45 | 6625-01-139-2512 |
| Oscilloscope AN/USM-488 | TBD |
| Test Set, Transistor TS-1836/U | 6625-00-893-2628 |

d. No special tools are required for maintenance or repair of this equipment.

Section II. TROUBLESHOOTING

WARNING

Death on contact may result from contact with high voltage in this equipment. The high voltage power supply produces 680 volts dc.

2-4. General Information

Troubleshooting has three steps: sectionalization, localization, and isolation.

- \ Sectionalization means tracing the fault to a module or assembly.
- Localization means tracing the fault to a subassembly within a module or assembly.
- Isolation means pin pointing the specific part or connection causing trouble.

2-5. Procedures

- a. Check meter readings and other visual signs to sectionalize trouble.
- b. Check for dirt, dust, or moisture.
- c. Check for loose screws or nuts.
 - (1) *Operation.* An operational test can help pinpoint trouble quickly (TM 11-6665-230-12).
 - (2) Use of the *troubleshooting table.* The troubleshooting table, table 2-1, lists common symptoms, troubles, and corrective measures. Not all trouble symptoms are listed in the table, so use it as a guide for analyzing symptoms not listed.
 - (3) *Test point data.* See figure 2-1, figure 2-2, and figure FO-1. Use with the troubleshooting chart to isolate defective parts.
 - (4) *Removing and replacing parts.* Refer to TM 11-6665-230-40P.

2-6. Symptom Recognition

- a. This is the first step in the troubleshooting procedure and is based on a complete knowledge and understanding of equipment operating characteristics. Not all equipment troubles are the direct result of component failure. Therefore, a trouble in an equipment is not always easy to recognize since all conditions of less than peak performance are not always apparent. This type of equipment trouble is usually discovered while accomplishing preventive maintenance procedures, such as the preventive maintenance checks and services shown in TM 11-6665-230-12.
- b. After an equipment trouble has been recognized, all the available aids designed into the equipment should be used to further elaborate on the original trouble symptom. Also, checking or otherwise manipulating the operating controls may eliminate the trouble.
- c. The next step in troubleshooting is to formulate a number of logical choices as to the causes and likely location (functional section) of the trouble. The overall functional description (para 1-16) and its associated block diagram (fig. FO-1) should be referred to when selecting possible faulty functional sections.

2-7. Troubleshooting

- a. The troubleshooting table lists the common malfunctions you may find during the maintenance of Radiac Set AN/PDR-27R. You should perform the tests/inspections and corrective actions in the order listed.
- b. Use the troubleshooting table to localize and isolate trouble. The table supplements the operational checks, and PMCS tables in TM 11-6665-230-12. Also, the table is designed to be used with the test point data.
- c. This manual cannot cover all the troubles that may occur, nor all tests or inspections and corrective actions. If a trouble is not listed or cannot be corrected by doing the corrective actions, notify your supervisor.
- d. When using the troubleshooting table, the numbered statements represent the malfunction or particular trouble to be remedied. The second indenture notes what test or inspection is to be performed in an attempt to isolate the trouble. The third indenture lists the corrective action to eliminate the trouble.

Table 2-1. Troubleshooting

| MALFUNCTION | TEST OR INSPECTION | CORRECTIVE ACTION |
|---|---------------------------|--------------------------|
| 1. Meter 1M1 indicates zero when the function switch is set on BAT COND. | | |
| Step 1. Check battery connections for corrosion and broken leads. | | |
| Step 2. Check contacts on function switch. | | |
| Step 3. Check meter 1 M1. (Use meter limited to 50 microamps.) | | |
| Replace, as required. | | |
| 2. At test point (1), voltage reads less than 5 V dc, and cannot be adjusted with potentiometer 1R3. | | |
| Check passercircuit, transistor 1A1Q1. | | |
| Replace low voltage assembly 1A1. | | |
| 3. At test point (1), the voltage reads 1 V dc and zero current, or reads battery level voltage and 60-80 MA. | | |
| Check differential amplifier circuit, transistors 1A1Q2 and 1A1Q3. | | |
| Replace low voltage assembly 1A1. | | |
| 4. At test point (1) and (2), voltage reads 5 V dc or less, and current reads 60-80 MA. | | |
| Check multivibrator circuit, transistors 1A1Q5 and 1A1Q6. | | |
| Replace low voltage assembly 1A1. | | |
| 5. Test point (3) indicates a low reading of 340 V dc, no indication on meter 1M1 and no clicks are audible in the headset. | | |
| High voltage assembly 1A2 is defective. | | |
| Evacuate to a higher level of maintenance. | | |
| 6. A steady tone is heard in the headset on BAT COND and 500 mR/hr range. Meter 1M1 reads full scale on all ranges. | | |
| Check voltage quadruple circuit, test point (4). Diodes 1A1CR1 through 1A2CR4 are shorted. | | |
| Evacuate high voltage assembly 1A2 to a higher level of maintenance. | | |
| 7. At test point (5) a lower reading than 680 V dc is indicated. | | |
| Evacuate high voltage assembly 1A2 to a higher level of maintenance. | | |
| 8. No indication on Meter 1M1 on any scale. | | |
| Check Geiger-Mueller tubes 2V1 and 2V2 and associated circuits at test points (6) and (7). | | |
| Replace Geiger-Mueller tubes 2V1 and 2V2, and recalibrate the radiacmeter. | | |
| 9. Regardless of radiation intensity, meter 1M1 indicates a constant reading. | | |
| Check limiter and differentiating amplifier circuits: transistor 1A1Q7, diodes 1A1CR4 and 1A1CR5 at test point (8). | | |
| Replace low voltage assembly 1A1. | | |
| 10. Meter 1M1 pegs on all ranges except when function switch is on BAT COND or displays zero on all ranges except BAT COND. | | |
| Step 1. Observe test points (9) and (10) monostable multivibrator circuit. | | |
| Step 2. Check transistors 1A1Q8 and 1A1Q9. | | |
| Replace low voltage assembly 1A1. | | |
| 11. Meter 1M1 indicates erratically or pegs on 500 range. | | |
| Step 1. Check clamp circuit at test point (11). | | |
| Step 2. Check transistor 1A1Q11. | | |
| Replace low voltage assembly 1A1. | | |

Table 2-1. Troubleshooting - Continued

| MALFUNCTION | TEST OR INSPECTION | CORRECTIVE ACTION |
|---|---|---|
| 12. Audible clicks in headset, and meter 1M1 does not indicate. | Check meter 1M1, linkage switch contact, and leads. | Replace meter 1M1 or switch 1S1, as applicable. |
| 13. No clicks in headset, meter 1M1 is normal. | Check headset circuit. | Replace Headset H-43B/U. |
| 14. Meter scales do not change when range switch is rotated. | Check meter linkage assembly. | Tighten setscrews. |
| 15. Meter 1M1 is not illuminated when switch 1S2 is depressed. | Check switch and lamp. | Replace as applicable. |

Table 2-2. Transistor Voltages

| TRANSISTOR | Voltage (Volts DC) to Ground | | |
|-------------------|-------------------------------------|----------|----------|
| | E | B | C |
| Q1 2N396 A | 6-9 | 6-9 | 5.0 |
| Q2 2N1711 | 2.0 | 2.5 | 6-9 |
| Q3 2N1711 | 2.0 | 2.5 | 5.0 |
| Q4 OMITTED | | | |
| Q5 2N404 | 5.0 | 5.5 | 0.3 |
| Q6 2N404 | 5.0 | 5.5 | 0.3 |
| Q7 2N1711 | 0.25 | 0.8 | 2.5 |
| Q8 2N1711 | 0 | 0.3 | 5.0 |
| Q9 2N1711 | 0 | 0.6 | 0.1 |
| Q10 2N388 | 4.8 | 3.0 | 5.0 |

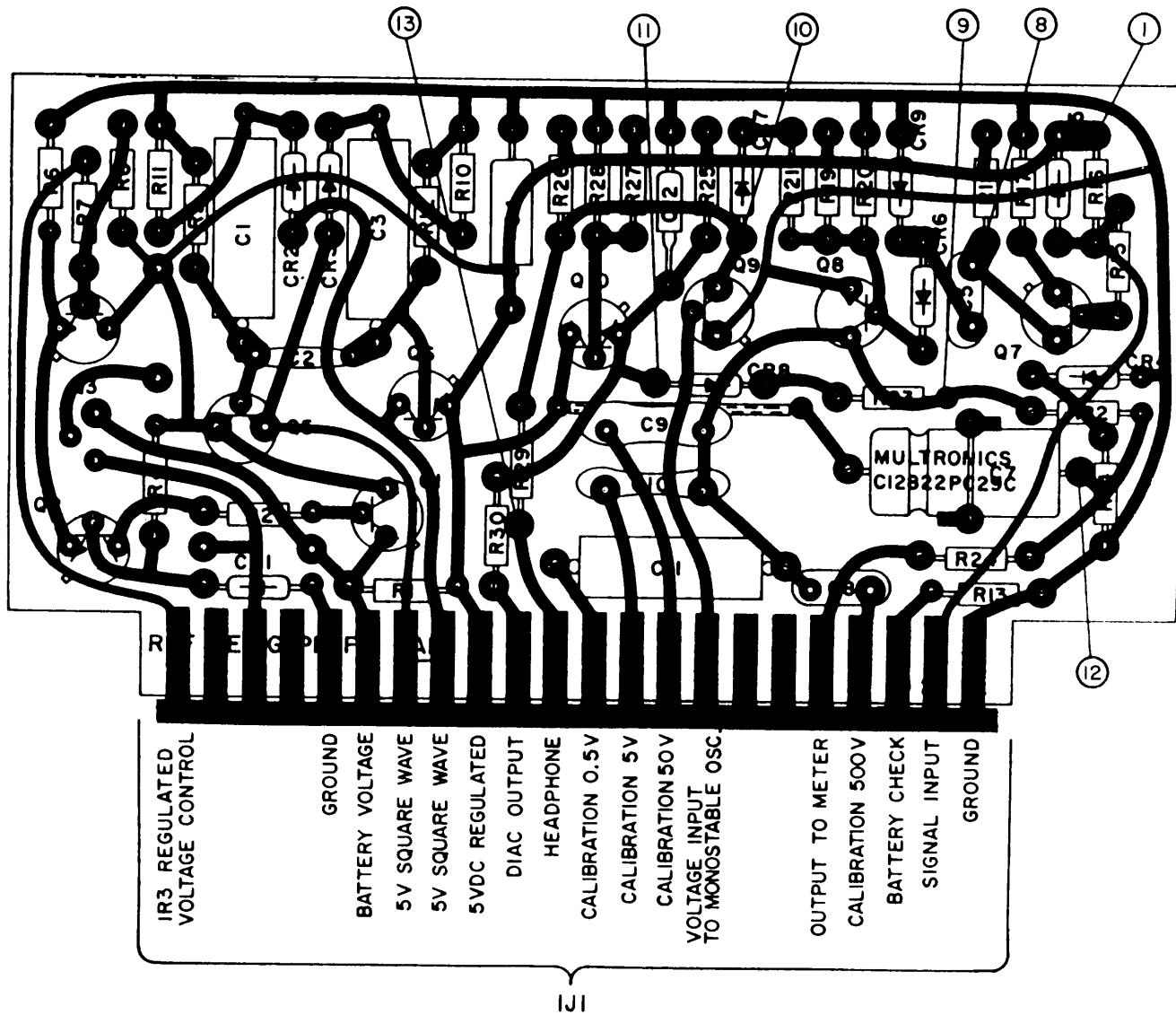


Figure 2-1. Low Voltage Assembly, 1A1, Component and Test Point Locations.

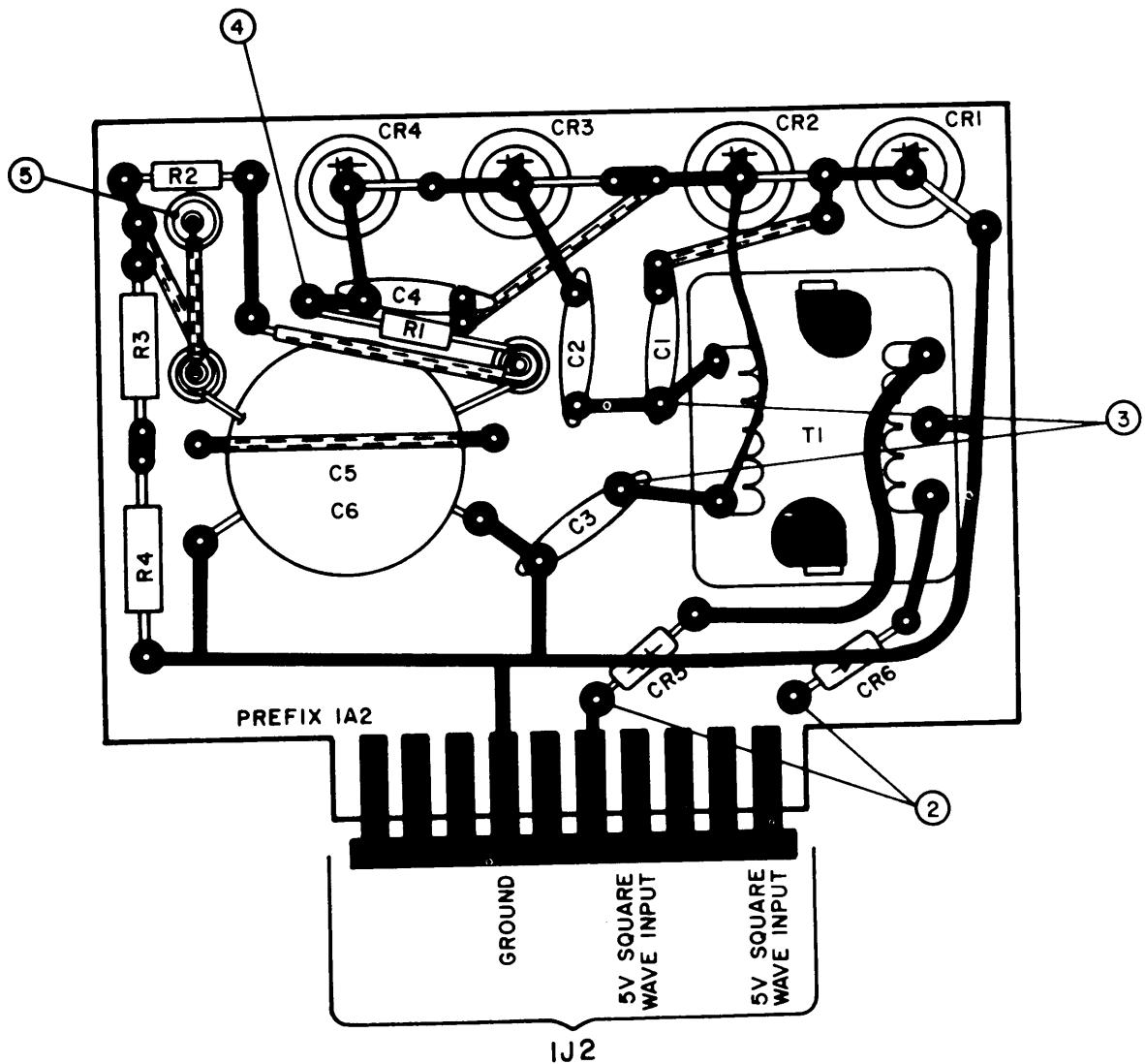


Figure 2-2. High Voltage Assembly 1A2, Component and Test Point Locations.

Section III. MAINTENANCE PROCEDURES

2-8. Operational Check

An operational check of this equipment shall be performed in accordance with the PMCS chart (TM 11-6665-230-12).

2-9. Removal and Replacing Parts

Repair parts are listed and illustrated in the repair parts and special tools list (TM 11-6665-230-40P) covering general support maintenance for this equipment.

- a. *Radiac Detector DT-196/PDR-27.* Removal and replacement of Geiger-Mueller tube 2V1.

- (1) Unscrew and remove gland nut (14) completely.
- (2) Remove electron tube holder (16) from electron tube housing (19).

CAUTION

Care should be taken not to bend the assembly or put strain on the electron tube holder.

NOTE

Replacement of Geiger-Mueller tubes 2V1 and 2V2 will require recalibration of this equipment. However, even though the radiacmeter may be inaccurate with respect to absolute intensity, it will still be useable to indicate relative intensity within any one scale position. This means that it is possible to recognize in which of two locations the intensity is higher, even though the actual intensities are in error. If readings are taken in the two locations on the same position, the reading correctly represents the higher intensity.

- (3) Carefully remove Geiger-Mueller tube 2V1 (18) from the electron tube holder (16).
 - (4) Insert the replacement tube on the electron tube holder (16).
 - (5) Insert the tube holder assembly (16) into the electron tube housing (19). Observe the precautions of b below.
 - (6) Replace and tighten the gland nut (14).
- b. *Removal and Replacement of Geiger-Mueller Tube 2V2,*

CAUTION

The mica window is only .005 inches thick, and is extremely fragile. Do not touch the window under any circumstances, as damage to the tube will result.

- (1) Remove the brass cap (6) located at cable end of probe.

CAUTION

Do not twist cable (11) at any time.

- (2) Remove the anode cap (23) of 2V2 with a pair of long-nose pliers.
- (3) Open the radiation shield (28) and remove the cover assembly (26).
- (4) Carefully remove the window guard (25), and care should be taken not to touch the mica window of 2V2.

(5) Gently push on the anode cap of tube 2V2 until the window projects enough to enable withdrawal of 2V2 (22) from its housing (1).

(6) Replace the O ring at the neck of 2V2. Slide the O ring completely to the window end of the housing (1).

(7) Push replacement tube 2V2 into the housing (19). Place the nut (24) and window guard (25) over the window to fully insert the tube.

(8) Insert the window guard (25) and large nut (24). Tighten securely.

(9) Close the radiation shield (28).

c. *Radiac Meter IM-203/PDR-27R*, Removal and replacement of low voltage assembly 1A1, high voltage assembly 1A2, and meter 1M1.

(1) Loosen the six screws located around the perimeter of the front panel of the radiacmeter housing and remove the front panel.

(2) Remove the two plug-in printed wiring boards (low voltage assembly 1A1 and high voltage assembly 1A2).

CAUTION

The high voltage lead to the smaller board (1A2) disconnects at the board by a separate plug on the base of the board.

(3) Unsolder both leads to the meter and tag the lead that goes to the positive terminal on the meter.

(4) Loosen the setscrews on the meter range linkage at the meter and at the range switch and carefully remove the linkage.

(5) Remove the four 6-32 x 9/16 inch meter mounting screws and associated washers. These screws also secure the chassis to the front panel.

(6) Carefully lift the chassis away from the front panel and slide the meter toward the top of the front panel.

(7) Carefully insert the new meter and position in place, making sure that the rubber gasket is properly positioned over the front panel window, and that all leads are clear of the meter frame.

(8) Position the chassis over the meter and insert the four mounting screws, making sure that the ground lug which was under the screw head nearest the calibration resistors is fastened. Tighten all mounting screws alternately in steps to maintain an even stress on the meter.

(9) Resolder meter leads, tagged lead to positive terminal.

(10) Reposition the meter range linkage on the meter shaft and range switch. Tighten setscrews on range switch shaft only.

(11) Set the range switch to BAT COND position, grasp the meter shaft (with long nose pliers, large tweezers, or similar tool) and rotate until the center mark of the batter scale is alined with the major division at midscale on the fixed scale of the meter. Carefully tighten the setscrews. Rotate the range switch, and check to be sure that the correct meter scale appears clearly in view, for each switch position.

Section IV. GENERAL TEST REQUIREMENTS

NOTE

The tests outlined in this section are designed to measure the performance capability of a repaired equipment. Equipment that is to be returned to the user should meet the standards given in these tests.

2-10. Initial Preparation

- a. Perform all tests at normal room temperatures.
- b. Perform all modification word orders applicable to this equipment before making the tests specified. DA PAM 310-1 lists all available MWO'S.

- c. The test equipment required to determine whether the radiac set complies with general support maintenance standards is located in section 1 of this chapter.
- d. Before testing the equipment, allow 5 minutes for it to reach a stable temperature.
- e. Obtain six BA-30 Batteries and check them.
- f. Insert the batteries in the radiacmeter battery compartment.
- g. Separate the top panel from the radiacmeter bottom casting by removing the six panel screws.

2-11. Regulator Output Test

- a. Set radiacmeter range switch 1S1 to 50 and the multi meter RANGE switch to 10 V dc.
- b. Connect the multimeter between test point ① and ground.
- c. Adjust radiacmeter regulator output control 1R3 until + 5 ±0.1 volts is indicated on the multimeter.
- d. Disconnect the multimeter from the radiacmeter.

WARNING



KRYPTON 85

Radioactive Test Sample MX-7338/PDR-27 contains 5 millicuries of KRYPTON 85. Damage to body tissue can result from mishandling.

Refer to TM 3-6665-264-10 for specific instructions on control, safe handling, inspection, storage, and disposition of the test sample.

2-12. Operational and Headset Test

- a. Connect the headset to headphone jack 1J3 on the radiacmeter top panel and set the radiacmeter range switch to 500.
- b. Remove the radioactive test sample from the carrying case. Hold the test sample against the small cylinder of the radiac detector probe; a clicking sound should be heard in the headset.
- c. Disconnect the headset and replace the test sample into the carrying case.

2-13. Rate-Meter Movement Test

- a. Remove the batteries from the radiacmeter battery compartment.
- b. Connect the multimeter, with its RANGE switch set to 10 V dc, to a 6 V dc 50 ma power supply. Adjust the dc power supply for an output of exactly + 6 V dc.
- c. Disconnect the multimeter from the dc power supply, and connect the dc power supply (observing correct polarity) to the electrical contacts in the battery compartment so as to electrically replace the batteries.
- d. Set the radiacmeter range switch to BAT COND; the radiacmeter should indicate 2-1/2 major scale divisions, or less.
- e. Disconnect the dc power supply from the radiacmeter; replace the batteries in the battery compartment.
- f. Insert the top panel into the radiacmeter bottom casing; be sure that the rubber gasket is properly positioned. Tighten the six panel screws to reseal the unit.

2-14. Checking Calibration**NOTE**

Before checking calibration of the AN/PDR-27R, determine positions of the X and Y axis bars, and the height control of the radiac calibrator set according to instruction given in TM 11-6665-227-12. Calibration should be checked in accordance with operating instructions contained in the technical manual. Check the calibration of each of the four ranges of the radiacmeter at four-fifths (0.4, 4, 40, and 400) of full-scale value with the radiac calibrator set. The meter indication must be four-fifths of full-scale value \pm 20 percent on each range.

APPENDIX A

REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS.

| | |
|--|---------------------|
| Report of Discrepancy | SF 364 |
| Quality Deficiency Report | SF 368 |
| Recommended Changes to Publications and Blank Forms..... | DA Form 2028/2028-2 |
| Discrepancy in Shipment Report | SF 361 |

A-3. TECHNICAL MANUALS.

| | |
|--|----------------------|
| Operator's Manual: Radioactive Test Sample, Krypton 85, Gamma MX-7338/PDR-27R | TM 3-6665-264-10 |
| Administrative Storage Requirements | TM 740-90-1 |
| Destruction of Army Electronics Material | TM 750-244-2 |
| Field and Depot Maintenance Repair and Special Tools List; Headset, Electrical H-43B/U | TM 11-5965-247-35P |
| Operator's and Organizational Maintenance Manual: Calibrator Set Radiac, AN/UDM-2 (NSN 6665-00-179-9037) | TM 11-6665-227-12 |
| Hand Receipt | TM 11-6665-230-12-HR |
| Operator's and Organizational Maintenance Manual: Radiac Set AN/PDR-27R (NSN 6665-00-961-0846) | TM 11-6665-230-12 |
| Organizational Maintenance Repair Parts and Special Tools List for Radiac Set AN/PDR-27R (NSN 6665-00-961 -0846) | TM 11-6665-230-20P |
| General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Radiac Set AN/PDR-27R (NSN 6665-00-961-0846) | TM 11-6665-230-40P |

A-4. MISCELLANEOUS PUBLICATIONS.

| | |
|---|----------------|
| Consolidated Index of Army Publications and Blank Forms | DA Pam 310-1 |
| The Army Maintenance Management System | DA Pam 738-750 |

APPENDIX E

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E-1. Scope

This appendix lists expendable supplies and materials you will need to operate and maintain the AN/PDR-27R. These items are authorized to you by CTA-50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

E-2. Explanation of Columns

a. *Column 1- Item Number.* This number is assigned to the entry in the listing and is referenced in the narrative instruction to identify the material (e.g., "Use cleaning compound, item 5, App. D").

b. *Column 2- Level.* This column identifies the lowest level of maintenance that requires the listed item.

C - Operator/Crew

O - Organizational Maintenance

c. *Column 3 - National Stock Number.* This is the National stock number assigned to the item; use it to request or requisition the item.

d. *Column 4 - Description.* Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

e. *Column 5 - Unit of Measure (U/M).* Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

EXPENDABLE SUPPLIES AND MATERIALS LIST

| (1) ITEM NUMBER | (2) LEVEL | (3) NATIONAL STOCK NUMBER | (4) DESCRIPTION | (5) U/M |
|---------------------------|------------------|--|----------------------------|----------------|
| 1 | c | 6135-00-120-1020 | Battery, Dry BA-30 (80063) | EA |
| 2 | 0 | 8040-00-390-7959 | Adhesive, EC 847 | QT |
| 3 | 0 | 8010-00-865-2054 | Enamel, Gray (81349) | QT |

GLOSSARY

DEFINITION OF UNUSUAL TERMS

| | |
|----------------|---|
| INTENSITY | The energy (of any radiation) incident upon (or following through) unit area, perpendicular to the radiation beam, in unit time. As applied to nuclear radiation, the term intensity is sometimes used to express the exposure dose rate at a given location in roentgens or milliroentgens per hour. |
| MILLIROENTGENS | One-thousandth of a roentgen (abbreviation mR/hr). |
| RADIOACTIVITY | The spontaneous emission of radiation, generally alpha or beta radiation, often accompanied by gamma radiation from the nuclei of an unstable element. |
| ROENTGEN | The international unit of x-radiation or gamma radiation equal to the amount of radiation that produces in one cubic centimeter of dry air at 0°C and standard atmospheric pressure ionization of either sign equal to one electrostatic unit of charge (also see milliroentgen). |
| SHIELDING | Is the act of reducing or preventing passage of particles or radiation. |

FOLDOUT INDEX

- Figure FO-1. RADIAC METER, IM-203/PDR-27R, SERVICING BLOCK DIAGRAM
- Figure FO-2. RADIAC SET, AN/PDR-27R, SCHEMATIC DIAGRAM

* U.S. GOVERNMENT PRINTING OFFICE: 1984-705-046:4228

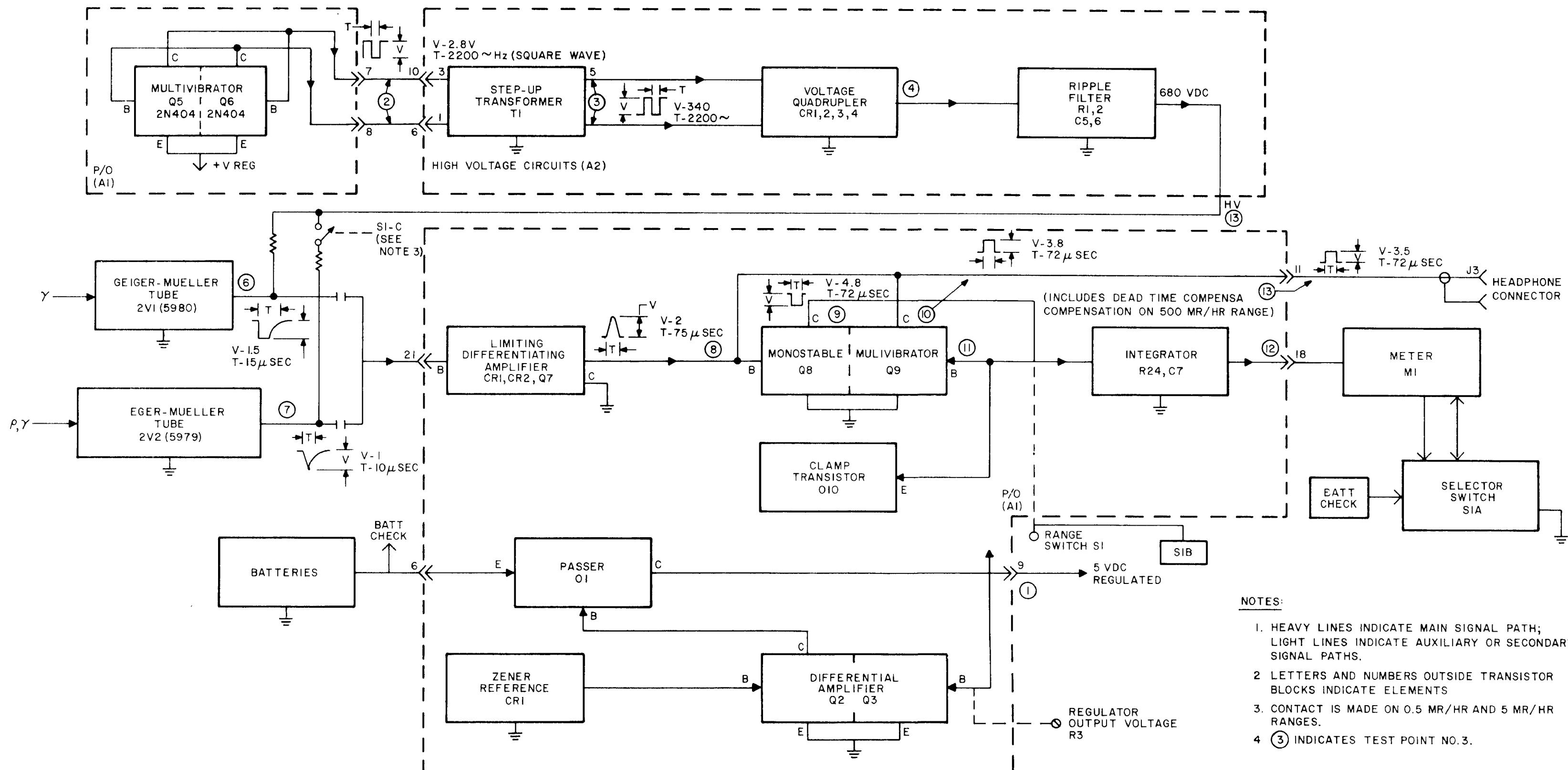
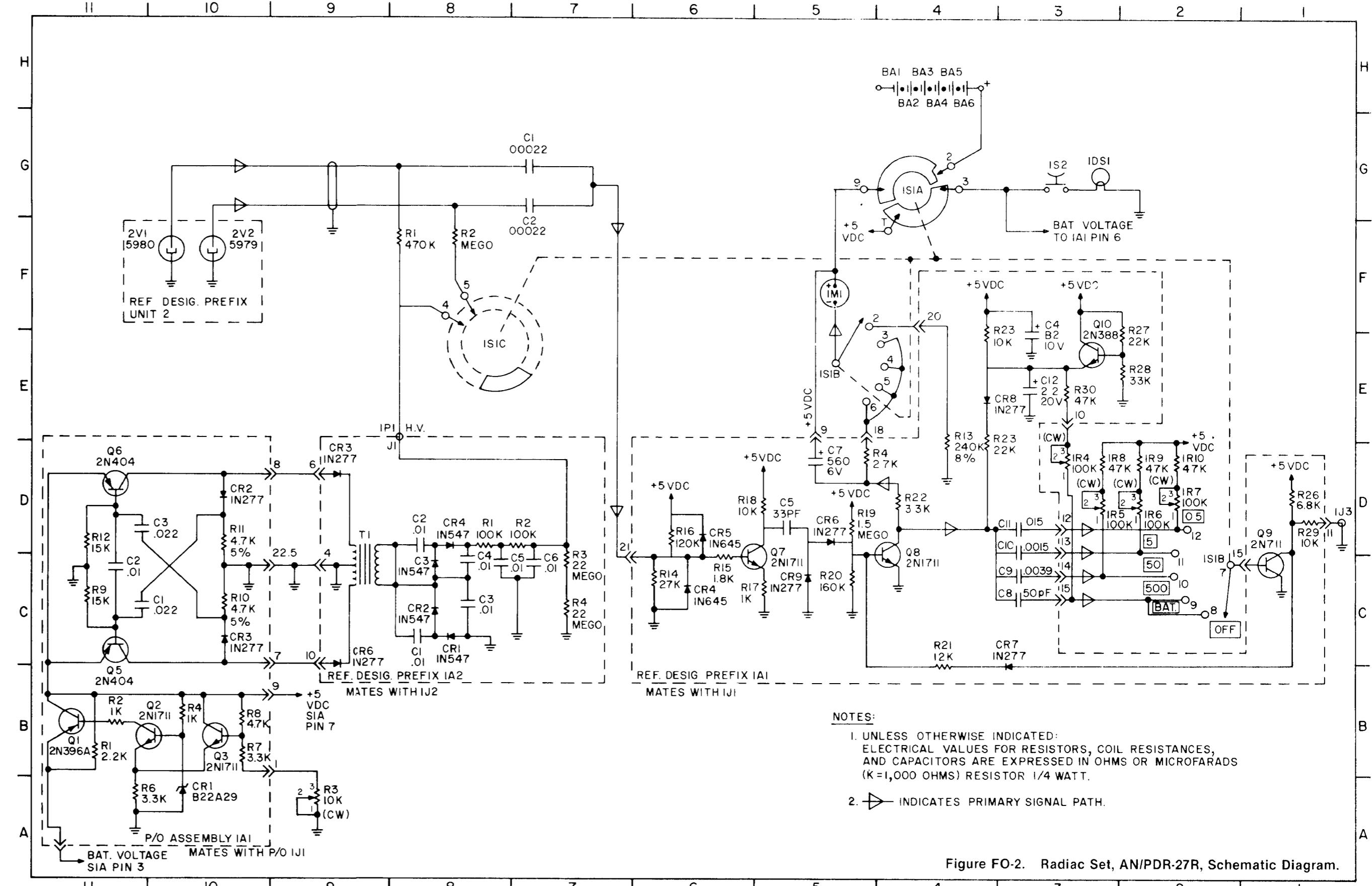


Figure FO-1. Radiac Meter, IM-203/PDR-27R Servicing Block Diagram.

PART LOCATION INDEX

| REF DESIG | LOC | REF DESIG | LOC | REF DESIG | LOC |
|---------------------|---------|--------------|---------|--------------|-----|
| UNIT 1 | | | | | |
| ASSY 1A1 (Cont.) | | ASSY 1A2 | | | |
| BA1 | 4H | CR6 | 5D | C1 | 8C |
| BA2 | 4H | CR7 | 3C | C2 | 8D |
| BA3 | 4H | CR8 | 4E | C3 | 8C |
| BA5 | 4H | CR9 | 5C | C4 | 8C |
| BA6 | 4H | CR9 | 5C | C5 | 7C |
| C1 | 7G | Q1 | 11B | C6 | 7C |
| C2 | 7G | Q2 | 10B | CR1 | 8C |
| DS1 | 3G | Q3 | 10B | CR2 | 8C |
| J1 | 6B,10A | Q4 | DELETED | CR3 | 8C |
| J2 | 6B,10A | Q5 | 11C | CR4 | 8C |
| J3 | 1D | Q6 | 11D | CR5 | 9D |
| M1 | 5F | Q7 | 5D | CR6 | 9C |
| P1 | 8E | Q8 | 4D | R1 | 8D |
| R1 | 8F | Q9 | 1D | R2 | 7D |
| R2 | 8F | Q10 | 3E | R3 | 7C |
| R3 | 9A | R1 | 11B | R4 | 7C |
| R4 | 3D | R2 | 11B | T1 | 9D |
| R5 | 3D | R3 | DELETED | E1A2J1 | 8E |
| R6 | 2D | R4 | 10B | UNIT 2 | |
| R7 | 2D | R5 | DELETED | V1 | 10F |
| R8 | 3D | R6 | 10A | V2 | 10F |
| R9 | 2D | R7 | 10B | | |
| R10 | 2D | R8 | 10B | | |
| S1A | 4G | R9 | 11C | | |
| S1B | 2D,5E | R10 | 10C | | |
| S1C | 8E | R11 | 10D | | |
| S2 | 3G | R12 | 11D | | |
| ASSY 1A1 | | R13 | 4E | | |
| C1 | 10C | R14 | 6C | | |
| C2 | 11C | R15 | 6C | | |
| C3 | 10D | R16 | 6D | | |
| C4 | 3F | R17 | 5C | | |
| C5 | 5D | R18 | 5D | | |
| C6 | DELETED | R19 | 5D | | |
| C7 | 5D | R20 | 5C | | |
| C8 | 3C | R21 | 4C | | |
| C9 | 3C | R22 | 4D | | |
| C10 | 3D | R23 | 3E | | |
| C11 | 3D | R24 | 4D | | |
| C12 | 3E | R25 | 3E | | |
| CR1 | 10A | R26 | 1D | | |
| CR2 | 10D | R27 | 2F | | |
| CR3 | 10C | R28 | 2E | | |
| CR4 | 6C | R29 | 1D | | |
| CR5 | 6D | R30 | 3E | | |



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TM 11-5840-340-12

PUBLICATION DATE

23 Jan 74

PUBLICATION TITLE

Radar Set AN/PRC-76

BE EXACT PIN-POINT WHERE IT IS

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

| PAGE NO | PARA GRAPH | FIGURE NO | TABLE NO | |
|---------|------------|-----------|----------|--|
| 2-25 | 2-28 | | | <p>Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°.</p> <p>REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.</p> |
| 3-10 | 3-3 | | 3-1 | <p>Item 5, Function column. Change "2 db" to "3db."</p> <p>REASON: The adjustment procedure the the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.</p> |
| 5-6 | 5-8 | | F03 | <p>Add new step f.1 to read, "Replace cover plate removed at step e.1, above."</p> <p>REASON: To replace the cover plate.</p> <p>Zone C 3. On J1-2, change "+24 VDC to "+5 VDC."</p> <p>REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.</p> |

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AND WHAT SHOULD BE DONE ABOUT IT:

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PARA-GRAPH

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THE METRIC SYSTEM AND EQUIVALENTS

NEAR MEASURE

Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
 1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
 1 Kilogram = 1000 Grams = 2.2 lb.
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
 1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
 1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
 1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

TEMPERATURE

$5/9(F - 32) = ^\circ C$
 212° Fahrenheit is equivalent to 100° Celsius

90° Fahrenheit is equivalent to 32.2° Celsius

32° Fahrenheit is equivalent to 0° Celsius

$9/5C + 32 = ^\circ F$

APPROXIMATE CONVERSION FACTORS

TO CHANGE

Inches.....
 Feet.....
 Yards.....
 Miles.....
 Square Inches.....
 Square Feet.....
 Square Yards.....
 Square Miles.....
 Acres.....
 Cubic Feet.....
 Cubic Yards.....
 Fluid Ounces.....
 nts.....
 arts.....
 allons.....
 Ounces.....
 Pounds.....
 Short Tons.....
 Pound-Feet.....
 Pounds per Square Inch.....
 Miles per Gallon.....
 Miles per Hour.....

TO

Centimeters.....
 Meters.....
 Meters.....
 Kilometers.....
 Square Centimeters.....
 Square Meters.....
 Square Meters.....
 Square Kilometers.....
 Square Hectometers.....
 Cubic Meters.....
 Cubic Meters.....
 Milliliters.....
 Liters.....
 Liters.....
 Liters.....
 Grams.....
 Kilograms.....
 Metric Tons.....
 Newton-Meters.....
 Kilopascals.....
 Kilometers per Liter.....
 Kilometers per Hour.....

MULTIPLY BY

2.540
 0.305
 0.914
 1.609
 6.451
 0.093
 0.836
 2.590
 0.405
 0.028
 0.765
 29.573
 0.473
 0.946
 3.785
 28.349
 0.454
 0.907
 1.356
 6.895
 0.425
 1.609

TO CHANGE

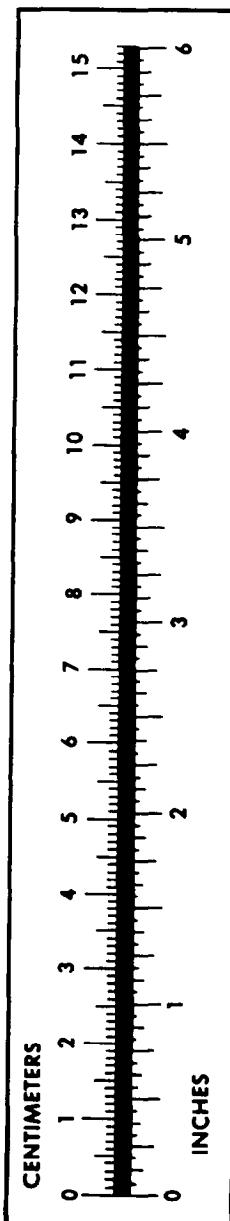
Centimeters.....
 Meters.....
 Meters.....
 Kilometers.....
 Square Centimeters.....
 Square Meters.....
 Square Meters.....
 Square Kilometers.....
 Square Hectometers.....
 Cubic Meters.....
 Cubic Meters.....
 Milliliters.....
 Liters.....
 Liters.....
 ers.....
 ms.....
 ograms.....
 Metric Tons.....
 Newton-Meters.....
 Kilopascals.....
 Kilometers per Liter.....
 Kilometers per Hour.....

TO

Inches.....
 Feet.....
 Yards.....
 Miles.....
 Square Inches.....
 Square Feet.....
 Square Yards.....
 Square Miles.....
 Acres.....
 Cubic Feet.....
 Cubic Yards.....
 Fluid Ounces.....
 Pints.....
 Quarts.....
 Gallons.....
 Ounces.....
 Pounds.....
 Short Tons.....
 Pounds-Feet.....
 Pounds per Square Inch.....
 Miles per Gallon.....
 Miles per Hour.....

MULTIPLY BY

0.394
 3.280
 1.094
 0.621
 0.155
 10.764
 1.196
 0.386
 2.471
 35.315
 1.308
 0.034
 2.113
 1.057
 0.264
 0.035
 2.205
 1.102
 0.738
 0.145
 2.354
 0.621



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